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Comparison of Dams' Estimated Transmitting Abilities from First Lactation Herdmates or All Records of Herdmates to Predict Sons' Milk Evaluations

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ABSTRACT

Multiple regression of genetic evaluations for milk yields of first lactations of 159 Holstein bulls on sire, dam, and maternal grandsire evaluations indicates that the weight for estimated transmitting ability of the dam calculated from the first record of the dam and first records of her herdmates is about as theoretically expected and is markedly superior both to estimated transmitting ability computed from the first record of the dam and all records of her herdmates and to estimated transmitting ability computed from all records of the dam and her herdmates. The latter two procedures gave similar results.

INTRODUCTION

Murphy et al. (1) found that the estimated transmitting ability (ETA) from milk records of first lactation of a cow and her herdmates (first/first ETA) is a better predictor of her son's evaluation by first lactations than the ETA calculated from all lactations of the cow and her herdmates (all/all ETA). Studies are reviewed in (1, 2). Murphy et al. (1) recommended that bull studs should use ETA's from first lactation rather than ETA's of all lactations as a guide to selecting dams to mate to superior proved sires to obtain sons for sampling. In the northeastern United States the present (1981) all lactation ETA list is a by-product of ETA's calculated for dairymen by the New York Dairy Records Processing Laboratory in Ithaca, NY. Calculation of ETA's with best linear unbiased prediction (BLUP) procedures from records on all relatives is costly. Rather than do the calculations twice (first/first ETA and all/all ETA) each time ETA's are calculated, a possible alternative is to maintain two ETA's in the cow's history file – the first would be the ETA calculated upon completion of her first lactation (first/all ETA) and the second would be a continually updated ETA based on all of her lactation records (all/all ETA). Both ETA's would involve all records on all cows in the herd at the time of calculation. Murphy et al. (1), however, did not address the first/all ETA option. Therefore, an attempt was made to approximate the ETA calculated at the time the first lactation was completed. The ETA's were calculated from the first lactation of the bull's dam, but calculations used all records of other cows in the herd including records made in year-seasons after the bull dam made her first record. Thus, the approximation was from use of records of herdmates after the bull's dam completed her first records. These ETA's will be denoted as (first/all + ETA).

RESULTS AND DISCUSSION

A total of 159 Holstein bulls had dams with first/all + ETA's. (Two from the original study (1) were lost in the matching process.) These dams also had first/first ETA's and all/all ETA's, which included the first lactation record of the dam. Evaluations for sires and maternal grandsires of bulls from the Northeast Artificial Insemination Sire Comparison (NEAISC) report for January, 1979, also were available from (1). The NEAISC includes only first lactations.

Empirical weights obtained from regression of son's NEAISC on various combinations of pedigree evaluations are in Table 1. The hope that the first/all + ETA's would do as well as the first/first ETA's was not fulfilled. In fact, the first/all + ETA's appear to be poorer than all/all ETA's for predicting the son's NEAISC based on the smaller squared multiple correlation coefficients. Weights for the equations with first/all + ETA's, however, are more similar to

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those for equations with the all/all ETA's than to those with the first/first ETA's.

Bias from using first/all + ETA's, however, as measured as a difference of the mean from the mean for first/first ETA's is much smaller compared to the difference from the mean for all/all ETA's as shown in Table 2. Part of the difference between means for all lactation and first lactation ETA's is due to a change in the base of 186 kg (R. W. Everett, personal communication, 1981). Best linear unbiased prediction is unbiased by selection if the first record of a cow is available. Preferential treatment of a cow or of a group of cows such as older cows can introduce bias which is not corrected for by BLUP or procedures based on selection index principles.

Reasons why first/all + ETA's differ from first/first ETA's in predicting evaluations of sons are not evident. First/all + ETA's might be slightly poorer than first/first ETA's if lactation 1 is genetically different from later lactations (2). Although these results do not show definitively that ETA's calculated upon completion of a cow's first record would be poorer than first/first ETA's, the results do argue against saving the first available ETA (first/all ETA) for use by bull studs unless more direct evidence suggests otherwise. More direct evidence would result from recalculation of ETA's with exclusion of records of herdmates made after completion of the bull dam's first lactation. Separate calculation of first/first ETA's seems indicated for use by bull studs unless first/all

TABLE 1. Regression coefficients to predict a bull's Northeast Artificial Insemination Sire Comparison (NEAISC) from sire's, dam's, and maternal grandsire's (MSG) evaluations.

Records[a] of dam and herdmates used in ETA	Sire NEAISC	Dam ETA	MGS NEAISC	R^2[b]
All/All		.263		.064
First/All+		.250		.043
First/First		.428		.083
(SE)[c]		(.114)		
All/All	.449	.158		.228
First/All+	.464	.159		.224
First/First	.449	.322		.252
(SE)	(.078)	(.105)		
All/All		.179	.166	.083
First/All+		.132	.196	.070
First/First		.324	.120	.091
(SE)		(.108)	(.093)	
All/All	.436	.128	.066	.231
First/All+	.447	.118	.074	.227
First/First	.451	.332	−.013	.252
(SE)	(.080)	(.129)	(.099)	
None	.489			.206
(SE)	(.076)			
None			.254	.061
			(.079)	
None	.449		.125	.220
	(.080)		(.076)	

[a]ETA = estimated transmitting ability. All/All = all records of dam including first, all records of herdmates. First/All + = first record of dam, all records of herdmates including records made after the first record of the dam. First/First = first record of dam, first records of herdmates.

[b]Squared multiple correlation coefficient (159 bulls).

[c]Largest of standard errors of partial regression coefficients.

TABLE 2. Means of and correlations among evaluations of relatives.

	Sire NEAISC	MGS NEAISC	Dam estimated transmitting ability[a] All/All	First/All+	First/First	Means[b] (kg)	Standard deviation (kg)
Son NEAISC	.454	.247	.252	.208	.288	221	245
Sire NEAISC		.299	.240	.175	.171	309	228
MGS NEAISC			.497	.515	.600	282	239
Dam ETA							
All/All				.783	.621	447	235
First/All+					.765	180	205
First/First						158	165

[a]NEAISC = Northeast Artificial Insemination Sire Comparison. MGS = maternal grandsire. ETA = estimated transmitting ability. All/All = all records of dam including first, all records of herdmates. First/All+ = first record of dam, all records of herdmates including records made after the first record of the dam. First/First = first record of dam, first records of herdmates.

[b]The base for the first/all+ and first/first ETA's was less than the base for the other evaluations by 186 kg.

ETA's give comparable predictions of sons' evaluations.

The recurring question of whether the genetic basis of first and later lactations is different enough to cause the difference in weights for predicting son's first lactation evaluation from first/first and all/all ETA's is raised by Powell et al. (2). They found genetic correlations of about .75 between first and later lactation records and of about .90 between later lactation records. Heritabilities were about .35 for first lactations dropping nearly linearly to .21 for fifth lactations. Rothschild and Henderson (3), however, using a maximum likelihood procedure to account for selection estimated a genetic correlation of .91 between first and second lactation records. They (3) found a difference of 587 kg between first lactation averages of cows with only first lactation records and those with second lactation records. Numerous other estimates of the genetic correlations in the literature generally range between these extremes (2).

With assumed heritabilities of .25 for first and .20 for second through fifth lactations and genetic correlations of .80 between first and second through fifth lactations, the theoretical regression of son's first lactation evaluation on a dam's five lactation ETA would be .77 as large as when heritabilities are all .25 and genetic correlations are all 1.00. The dam's ETA was constructed as if heritability was .25 and repeatability was .50. The son's evaluation was constructed for heritability of .25. The genetic correlations would need to be about .20 to account for the difference in regression coefficients of .33 for first/first ETA's and .13 for all/all ETA's as shown in Table 1 for the regression equations including sire, dam, and maternal grandsire evaluations. The regression of .33 for son evaluation on dam's first/first ETA agrees closely with the theoretical regression when the son has 40 to 60 daughter records (4). A different genetic basis of first and later lactations would seem to account for only 20 to 40% of the difference in regression coefficients for the "worst case" example of genetic correlations of .75 between first and later lactation records.

A study is needed to determine whether first/first ETA's or all/all ETA's are better for predicting a daughter's performance. Because the likelihood of preferential treatment is probably much higher for cows that have a chance to be bull dams than for most cows in the herd and because selection of heifer dams will be from a much wider range of cows, there appears to be chance that all lactation ETA's may be better for predicting daughter performance than first lactation ETA's.

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